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Abstract

CHARACTERISTICS AND CONSTRUCTION PROBLEMS OF EL 4

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EL 4 is the prototype of a new series of reactors moderated with heavy water and cooled by carbon dioxyde. It was studied with a double purpose :

- to realize a sufficiently large and complete reactor for testing the problems of construction and operation of this type of reactors.
- to keep in this installation the possibility of adapting the improvements (new materials, improved fuel elements) studied in the R. and D. program.

The first objective could not be considered without a considerable volume of preliminary work. This work included particularly the construction and testing from 1962 to 1964 of several prototype channels, out of pile, but under the actual temperature and pressure conditions. These tests showed the proper behaviour of the materials under the severe mechanical and chemical conditions of the reactor.

These installations will, furthermore, be available for testing further modifications before adapting them to the reactor. Important tests concerning the safety of the reactor in the avent of an explosion of the CO_2 circuit have also been carried out.

Construction itself began in July 1962 under the double direction of

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the Commissariat à l'Energie Atomique and Electricité de France. The civil engineering work will be finished in 1964. The airtight containment (in which it was considered preferable to house the reactor because of its prototype character) was built in pre-stressed concrete, a method which appeared to be particularly rapid and easy.

The main piece of the reactor is the heavy water tank. This tank is composed of two double end plates equipped with 216 tubes and joined by a steel cylinder. Some difficult welding problems according to the specifications were solved during the construction of these bottoms. A rigorous series of controls by radiographic and ultrasonic methods was adapted to a complicated geometry. The assembly of the reactor unit, and particularly of the array of tubes supplying the 216 channels, was studied in every detail and the connections to be employed were tested. The whole circuit is made in fairly classical materials (slightly alloyed steels) whose behaviour in the carbon dioxyde at 500°C was proved.

The CO_2 and heavy water circuits construction will begin in october 1964.

Aerodynamic tests were carried out for the helico-centrifugal blowers (of unit power 9 MW). The choice of a pressure as high as 60 kg/cm^2 does not seem to induce new problems in connection with leaks on the machine shafts.

Finally, the choice of a type of CO_2 - steam heat exchanger with forced circulation led Electricité de France to test the operation and stability of a prototype exchanger in its test plant. The reactor will be equipped with a depressurizing and desuperheating system which will allow the reactor to operate at 20 p. 100 of its nominal power whether the turbo-alternator is available or not.